

Which decarbonised building stock should we strive for and what barriers need to be overcome?

Overview of work by Sam Hamels
in the NEPBC project

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Cost-optimal building (stock) decarbonization

Barriers to renovation

Financial barrier

Primary energy factors

CO₂ intensities

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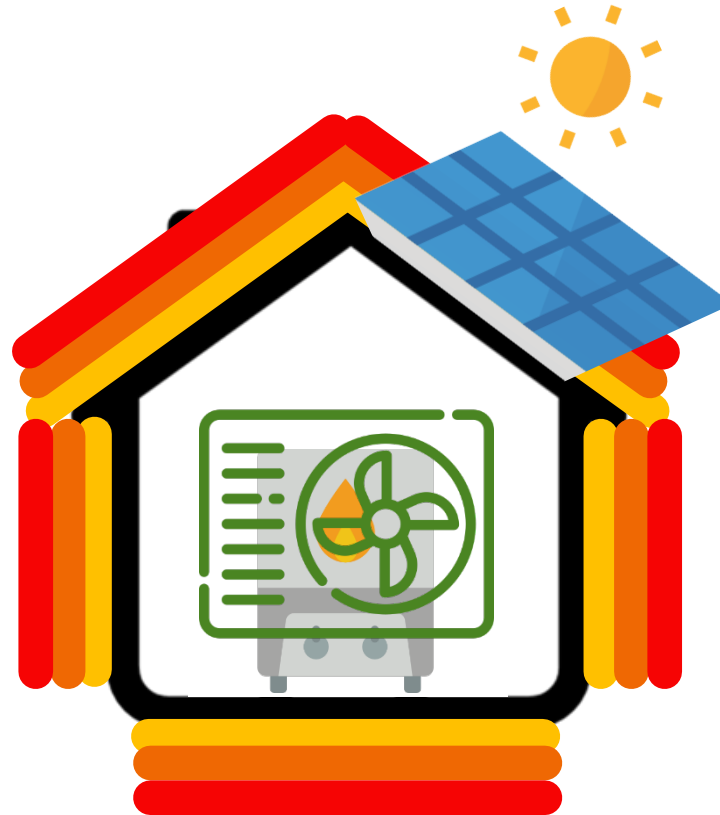
Cost-optimal building (stock) decarbonization

The individual building level

Complex optimisation

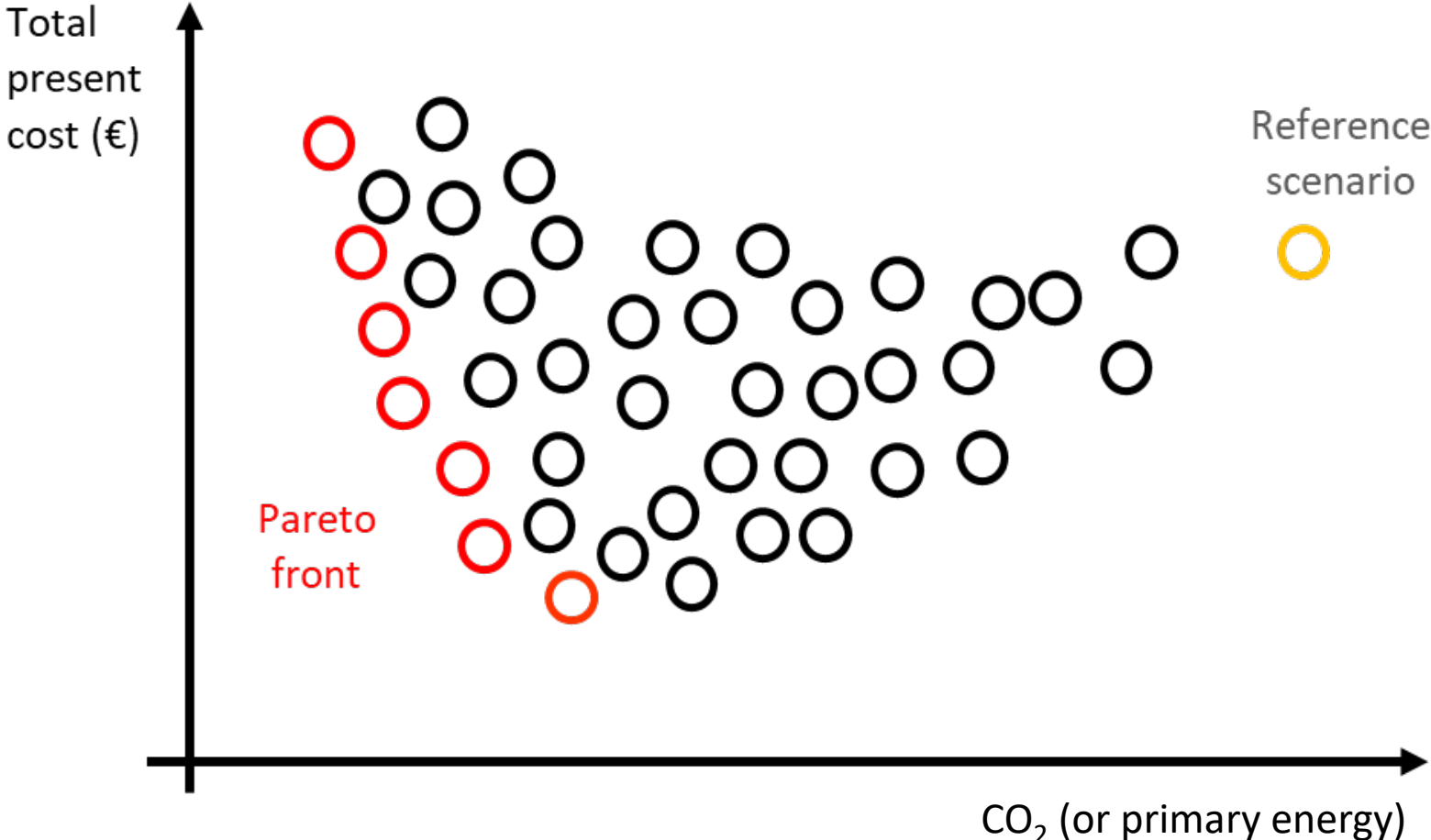
Trade-off's between every action you can take at the individual building level

Includes synergies and inter-dependencies



Cost-optimal building (stock) decarbonization

The individual building level



Cost-optimal building (stock) decarbonization

The individual building level

Performance gap

Modelling challenges

Rebound effects

Human behavior

Electricity bill

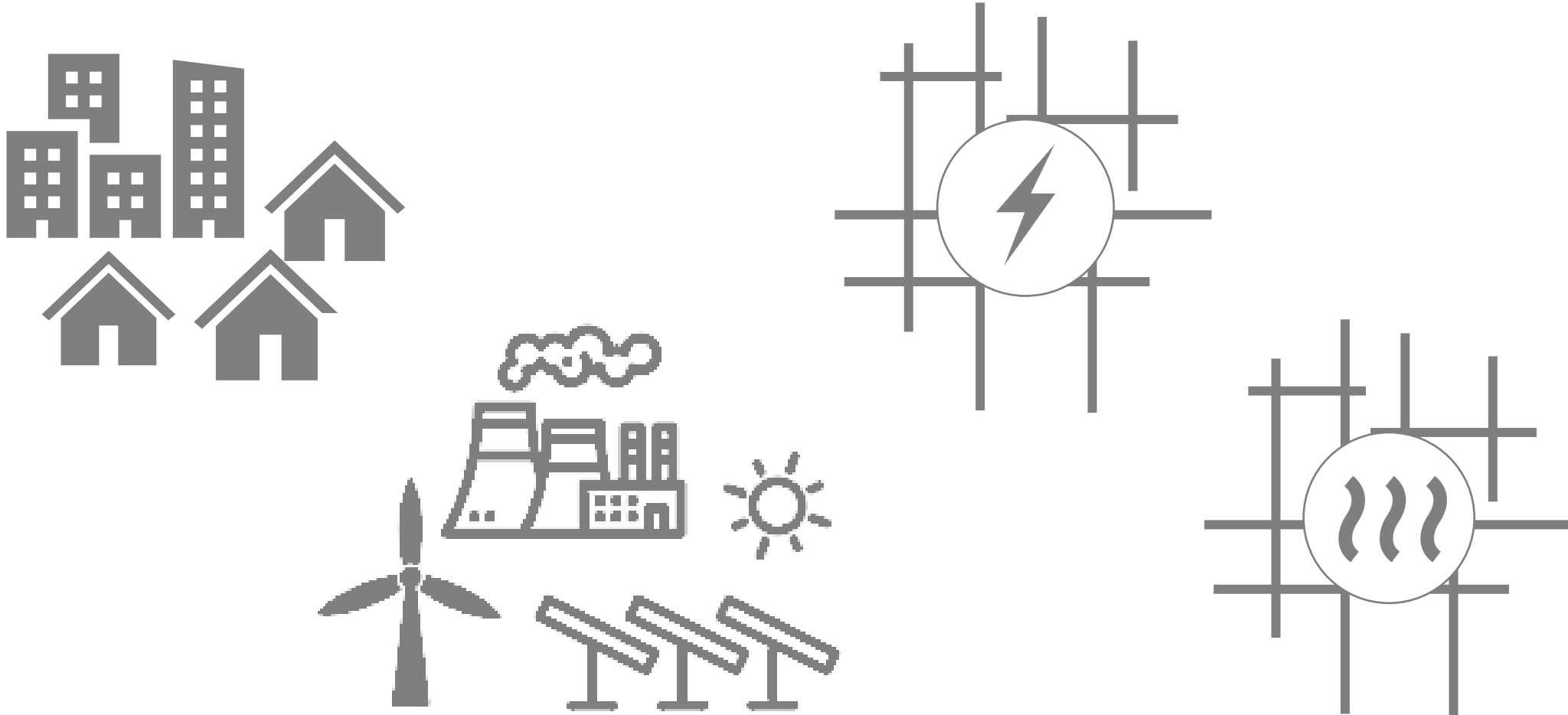
Capacity tariff ?

Real-time pricing ?

Smart self consumption ?

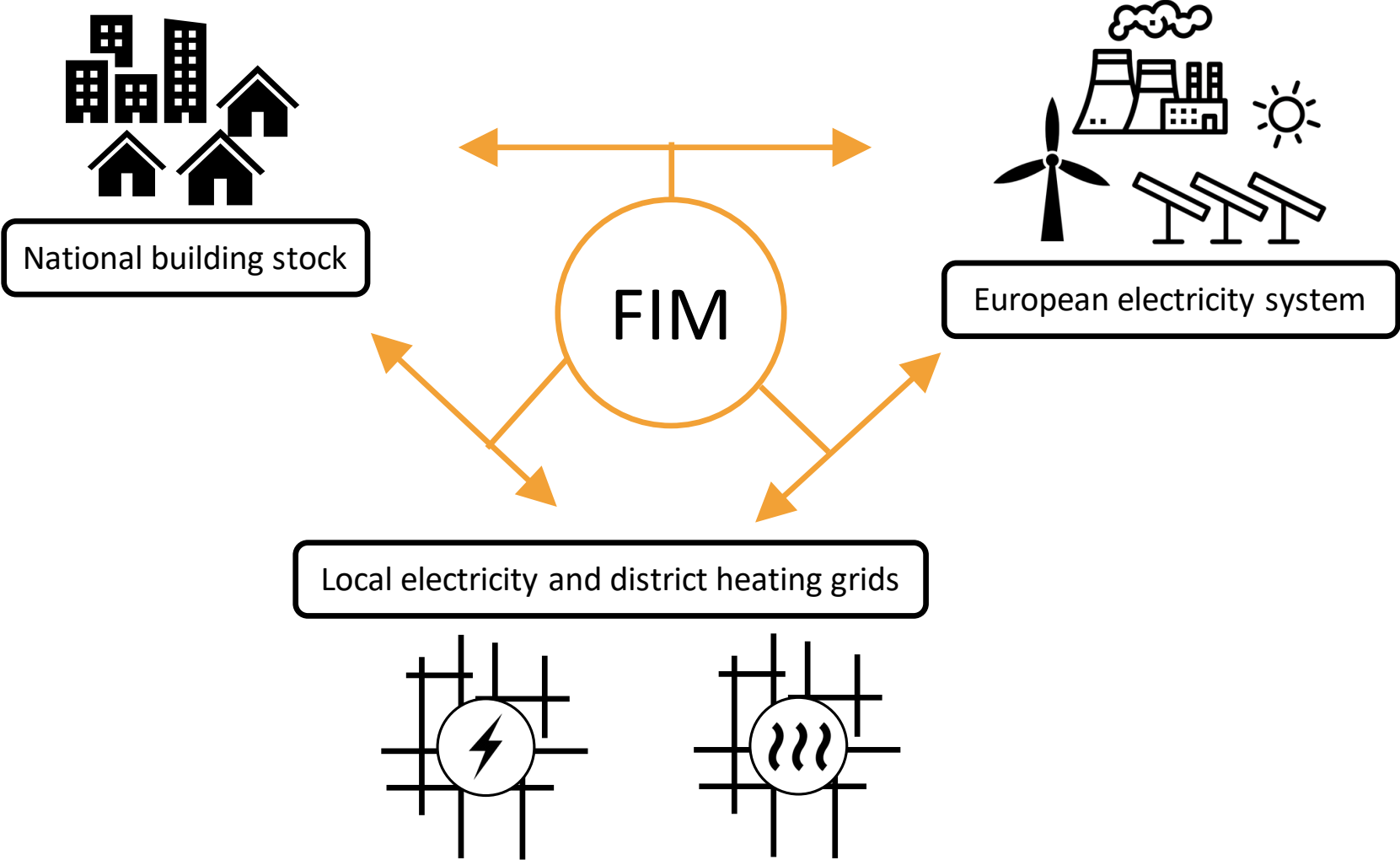
Cost-optimal building (stock) decarbonization

The societal level



Cost-optimal building (stock) decarbonization

The societal level



Cost-optimal building (stock) decarbonization

The societal level

Boundaries of feasible modelling complexity

Fundamental barriers in terms of input data availability

Academic search for (cost-)optimality goes on...
... but is it the wisest path to stay on?

Cost-optimal building (stock) decarbonization

Take-aways:

Cost-optimisation already incredibly complex at the individual building level, and even more so at the societal level

Move towards simpler heuristic-based approaches?

Cost-optimal building (stock) decarbonization

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What prevents people from renovating?
And what motivates them?

Barriers

Information availability problems
(availability, cost, accuracy,...)

Asymmetric information (moral hazard)

What prevents people from renovating? And what motivates them?

Barriers

Debt aversion and risk aversion

High discount rates (preference for the short-term, aversion for delayed gains,...)

Coordination problems (homeowner & societal level)

What prevents people from renovating?

And what motivates them?

Barriers

Energy performance not properly reflected in building market value

Access to capital (financial barrier)

What prevents people from renovating?

And what motivates them?

(non-economic) motivators:

Aesthetics

Thermal comfort

Health benefits

Convenience

What prevents people from renovating?

And what motivates them?

Take-away:

If you think you know what 'the' reason is people do not renovate, please read the report

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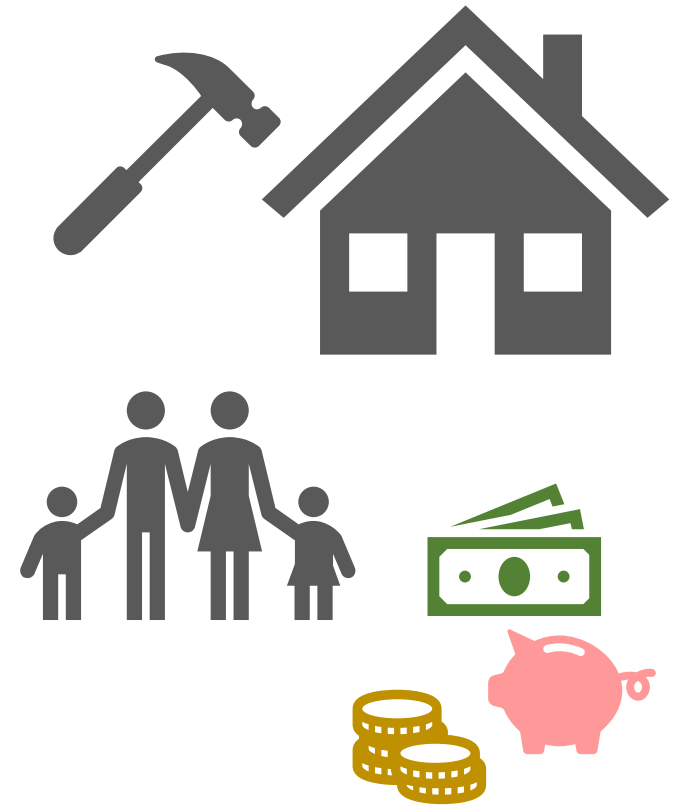
CO₂ intensities

Quantifying the financial barrier

2 empirical datasets, containing thousands of Flemish households

Simulation model to estimate their **renovation costs** and **financing capacities**, to estimate the **gaps**

Both **immediate** and **stepwise** renovation options considered



Financing capacity

Financing capacity

Extreme
fin. capacity shortage

Manageable
fin. capacity shortage

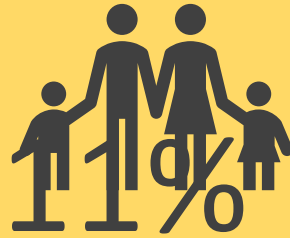
surplus

36%
>€25.000

47%

<€25.000

53%



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Research on the PEF (for electricity)

Why is it important?

Impact on competition between different technologies

Heat pumps <-> fossil boilers

Heat pumps <-> solar PV

Research on the PEF (for electricity)

Why is it important?

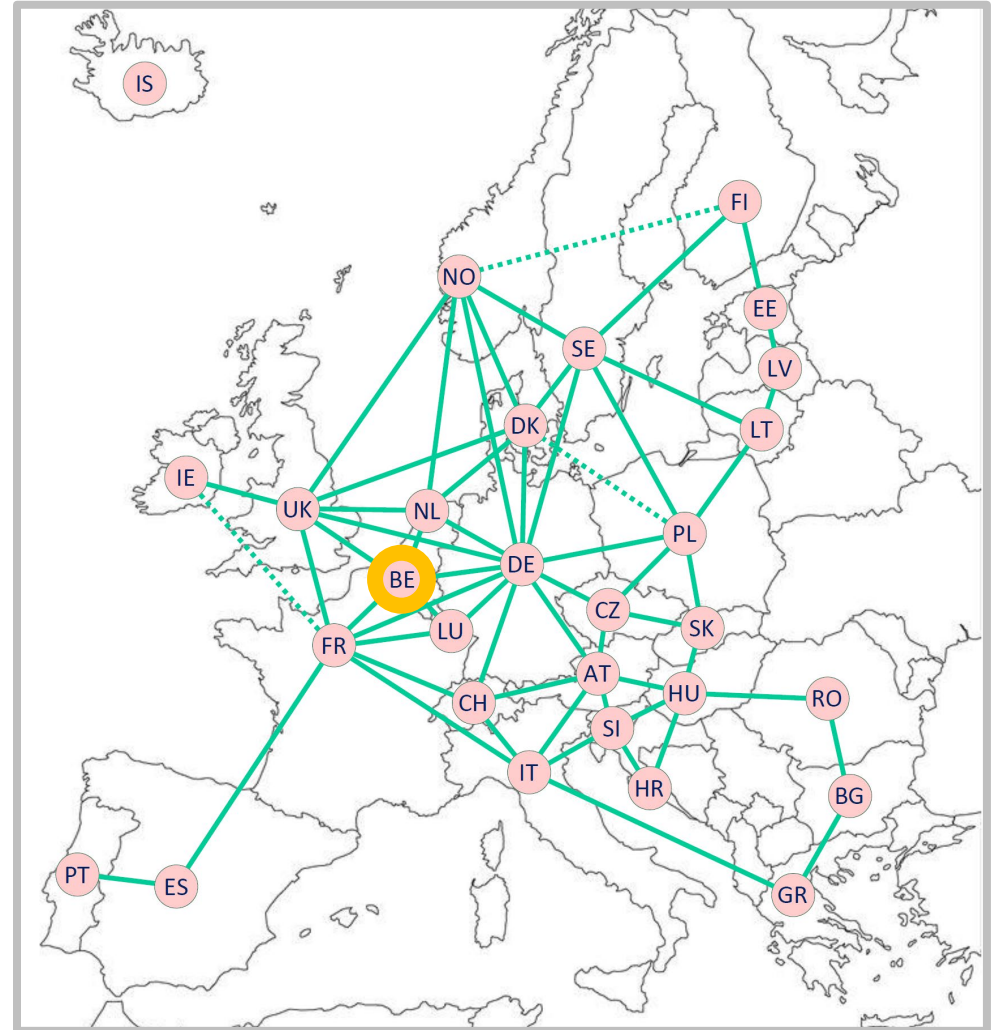
Two papers published

How are PEFs calculated in the literature?

European electricity system model to calculate PEFs

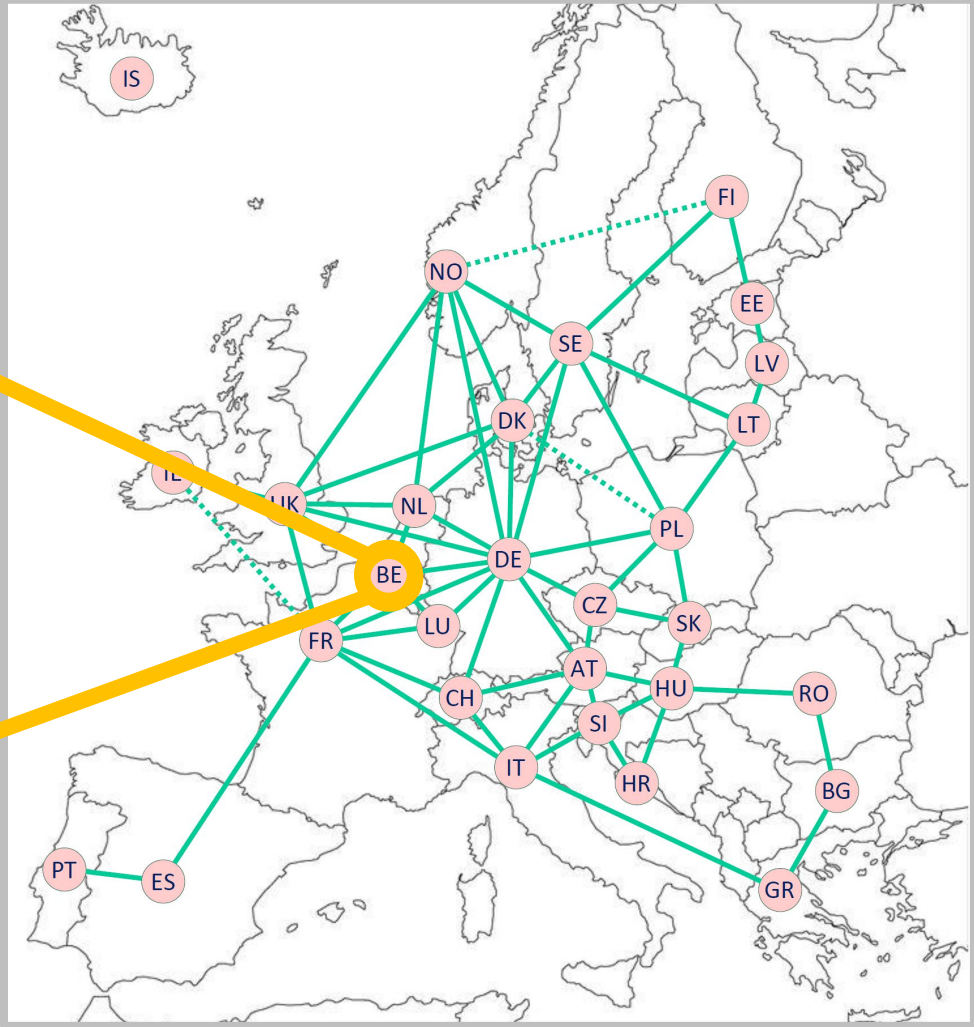
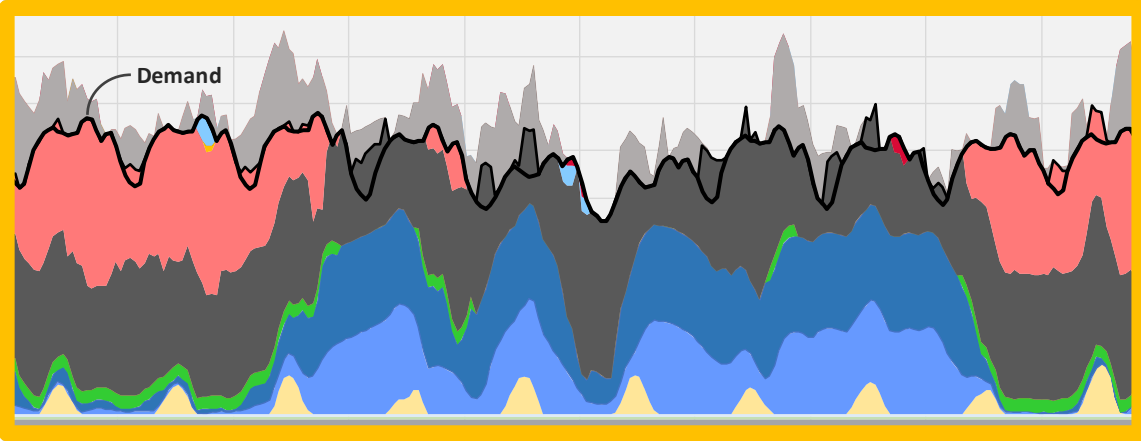
Model of the European electricity system

To calculate PEF values



Model of the European electricity system

To calculate PEF values



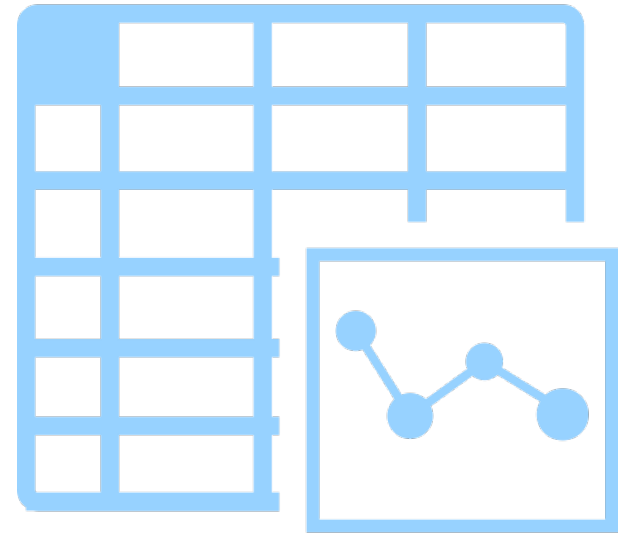
PEF value database created

28 countries

2025, 2030, 2040

On an hourly basis

Publicly available



Take-aways:

Nuclear phase-out will decrease PEF

PEF in Belgium not very seasonal

Using an hourly PEF does not make a big difference

Take-aways:

Should every Member State keep calculating their own PEF, as they see fit?

Full public transparency and explicit argumentation for why a PEF is calculated in a certain way is fundamental

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CO₂-intensities

Same two scientific publications

Take-away:

Should we keep focusing on primary energy?

Personal opinion: NO

EPBD allows MSs to implement CO₂ requirements for buildings



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